

First results of the CALLISTO-experiment: evidence for the formation of a hassate(VIII)

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Hassium, element 108, was produced in the fusion reaction $^{26}\text{Mg} + ^{248}\text{Cm}$ at the UNILAC accelerator of GSI [1]. A rotating target wheel with an average target thickness of $467\mu\text{g}/\text{cm}^2$ ^{248}Cm was used, partly together with a ^{152}Gd segment. After stopping in a He/O₂- mixture the recoils were oxidized, presumably to HsO₄, and were transported to the apparatus CALLISTO (Continuously Working Arrangement for Clusterless Transport of In-situ Produced Volatile Oxides), Fig.1. Nuclear reaction products could react with a NaOH surface under controlled humidity (2g H₂O/Kg gas); the nuclear decays of adsorbed species were detected with 16 PIPS-detectors (10x10mm² each), Fig. 2. In the detection array, a stainless steel plate, coated with 1 M ethanolic NaOH (on the average 20 μmol NaOH), is facing 4 detectors at a distance of 1mm. The volatile oxides are allowed to react with the thin alkaline layer, forming non-volatile products which are deposited. The deposition material was replaced every 60 minutes because the deposition efficiency decreases with time [1]. A possible explanation may be, that the alkaline surface is partially neutralized by CO₂, which is an impurity of the used gases and may be formed by a reaction of the carbon beam dump with the oxygen of the jet gas, too. Every 60 minutes, the 4 computer-controlled valves of the deposition and detection system switched one of the detector-arrays out of the gas flow. In this "service mode" the reactive surface can be renewed without interrupting the experiment. Thus a continuously measuring arrangement of 12 detectors was established. After 2 weeks of beam-time and an integral of 2.82×10^{18} beam particles, 5 correlated α -SF chains and one α - α - α -chain (Fig. 3,4) could be detected and attributed to the decay of Hs and / or Sg daughter. Due to pile-up from the high α -activity of Os, produced from the reaction $^{26}\text{Mg} + ^{152}\text{Gd}$ in the first part of the experiment, it was not possible to attribute 19 α - α -chains with appropriate energies and decay times to the decay of Hs; most of them were estimated to be random coincidences.

In analogy to OsO₄, HsO₄ presumably was deposited as Na₂[HsO₄(OH)₂], a hassate(VIII). A comparison of Hs to the Os-behavior (measured simultaneously) will be given.

References

[1] A. v. Zweidorf et al. GSI Scientific Report 2002, p. 175-177



Figure 1. Diagram of CALLISTO.



Figure 2. Photograph of a detector array.

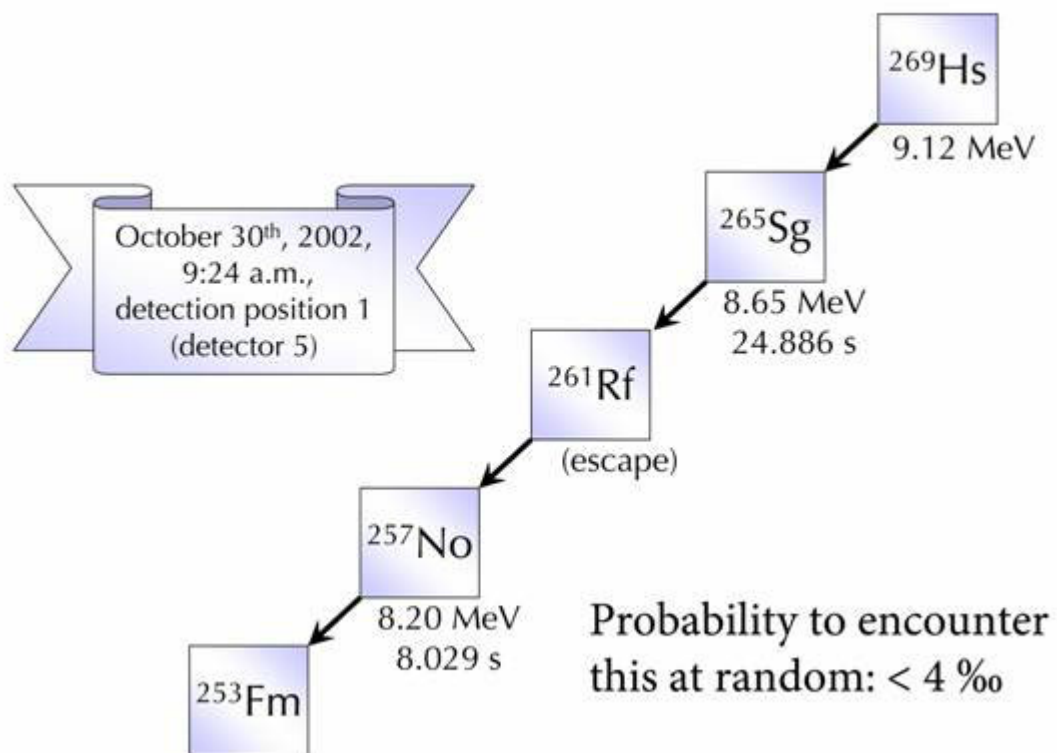


Figure 3. α - α - α -chain.

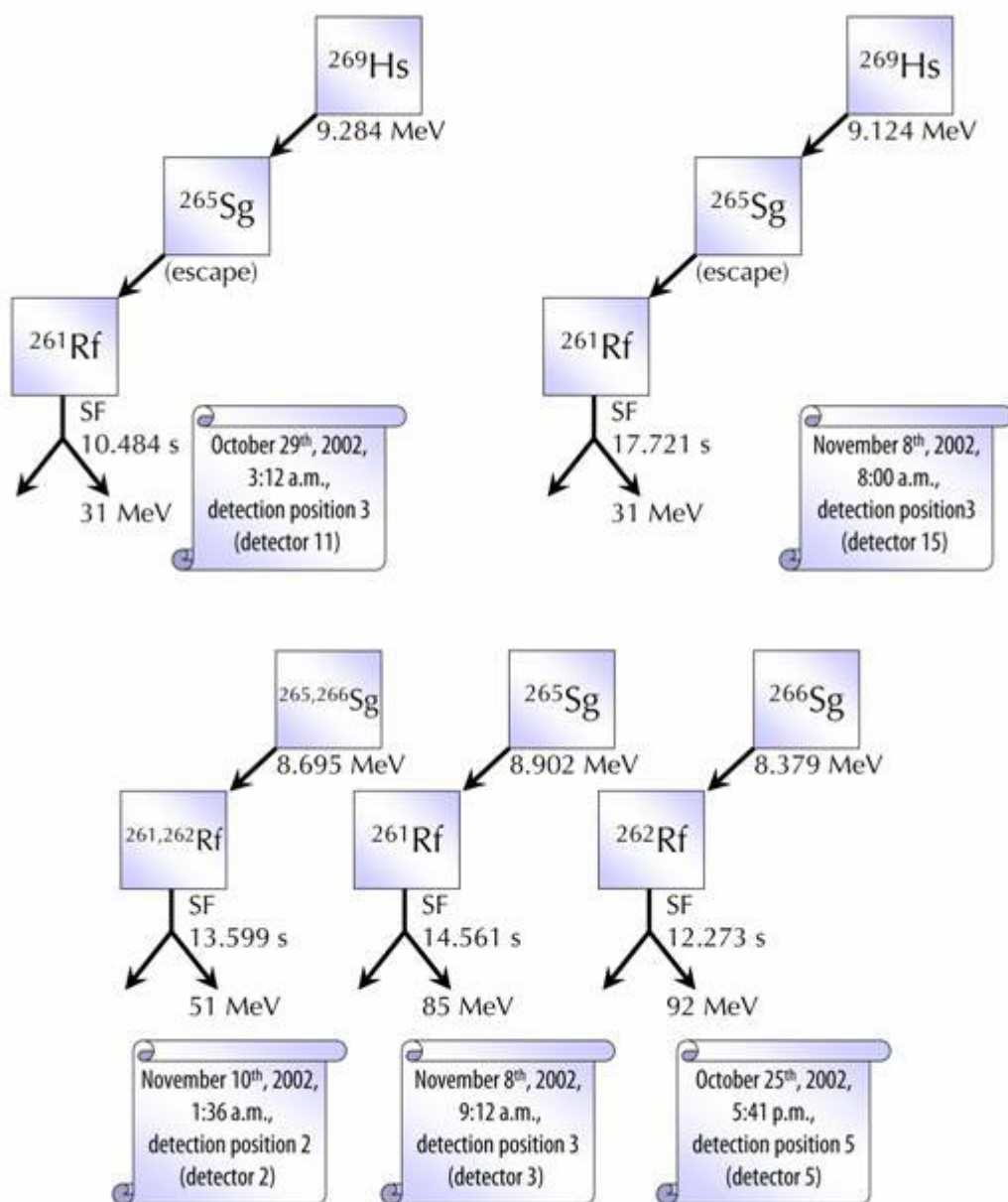


Figure 4. 5 α -SF –chains.